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ML Based Mental Stress Assessment Using Wearable Device

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Abstract: *This project details the design and deployment of a real-time stress monitoring system built on an STM32 microcontroller. The system fuses data from multiple physiological sensors MAX30102 for photoplethysmography (PPG), electrocardiogram (ECG), galvanic skin response (GSR), and temperature sensors to obtain a comprehensive view of a user's physiological state. A custom neural network model was trained to classify stress into three levels: low, moderate, and high. By analyzing parameters such as heart rate variability, blood oxygen saturation (SpO_2), skin conductance, and temperature shifts, the model achieved an accuracy of 87.3%. Real- time results are displayed on a 0.96-inch OLED screen, and the system can also store data to support ongoing model refinement. The project's novelty lies in embedding machine learning inference within a low- power, resource-limited microcontroller, proving that advanced AI analytics can be executed in real time on affordable embedded hardware. The system also incorporates a user-friendly interface that simplifies live monitoring and manual data labeling. This implementation illustrates the potential of AI-driven healthcare IoT systems, especially for stress detection and personalized wellness tracking.*

Keywords: Stress Detection, Machine Learning, STM32, Embedded AI, Multi-Sensor Fusion, Healthcare IoT, Neural Networks, Real-Time Processing

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